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ABSTRACT

This study investigates the effect of violent crime on school district-level achievement in English Language Arts (ELA) and Mathematics. The research design exploits geographic variation in achievement and crime across 337 school districts and temporal variation across seven birth cohorts of children born between 1996 and 2002. To generate causal estimates of the effect of crime on achievement, the identification strategy leverages exogenous shocks to crime rates arising from the availability of federal funds to hire police officers in the local police departments where the school districts operate. Results show that birth cohorts who entered the school system when violent crime was lower score higher in ELA by the end of eighth grade, relative to birth cohorts attending schools in the same district but who entered the school system when crime rates were substantially higher. A 10 percent decline in violent crime raises eighth-grade ELA achievement in the district by .04 standard deviations. Analyses by race/ethnicity and gender indicate that black children, Hispanic children, and boys experienced the largest gains in ELA achievement as violent crime dropped. The effects on Mathematics achievement are smaller and imprecisely estimated. These findings extend our understanding of the geography of educational opportunity in the United States and reinforce the idea that understanding inequalities in academic achievement requires evidence on what happens inside schools as well as what happens outside of schools.

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This study investigates the effect of violent crime on school district-level achievement in English Language Arts (ELA) and Mathematics. The research design exploits geographic variation in achievement and crime across 337 school districts and temporal variation across seven birth cohorts of children born between 1996 and 2002. To generate causal estimates of the effect of crime on achievement, the identification strategy leverages exogenous shocks to crime rates arising from the availability of federal funds to hire police officers in the local police departments where the school districts operate. Results show that birth cohorts who entered the school system when violent crime was lower score higher in ELA by the end of eighth grade, relative to birth cohorts attending schools in the same district but who entered the school system when crime rates were substantially higher. A 10 percent decline in violent crime raises eighth-grade ELA achievement in the district by .04 standard deviations. Analyses by race/ethnicity and gender indicate that black children, Hispanic children, and boys experienced the largest gains in ELA achievement as violent crime dropped. The effects on Mathematics achievement are smaller and imprecisely estimated. These findings extend our understanding of the geography of educational opportunity in the United States and reinforce the idea that understanding inequalities in academic achievement requires evidence on what happens inside schools as well as what happens outside of schools.

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Introduction

After reaching unprecedented high levels in the early 1990s, crime and victimization rates in the United States started a sustained decline that brought them to levels not seen since the 1960s. Between 1991 and 2015, the property crime rate fell by 50 percent, the violent crime rate fell by 51 percent, and the homicide rate fell by 54 percent (United States Department of Justice, 2015). In cities like New York or Los Angeles, the decline in the murder rate between the highest record in the 1990s and the level in 2015 was larger than 75 percent. Even cities that still today struggle with severe problems of community violence like Chicago and Detroit have experienced reductions in their murder rates of at least 30 percent between 1991 and 2015.[1]

This progress in making cities safer represents one of the most remarkable improvements in the quality of life in urban America in recent history (Sharkey, 2018b). While the literature has made a lot of progress in documenting the causes of this decline (Levitt, 2004; Zimring, 2006), much less is known about its consequences for individuals and communities. This study aims to fill this gap by estimating the impact of violent crime on the academic achievement of seven birth children who lived through the early stages of the crime decline.

The study of violent crime and inequality in academic achievement is motivated by evidence from ethnographic and quantitative studies showing that exposure to violent crime is a key pathway through which growing up in disadvantaged neighborhoods affects children's developmental trajectories (Burdick-Will, 2013; Burdick-Will et al., 2011; Harding, 2009; Harding et al., 2011; Sharkey, 2018a). The literature has made remarkable progress documenting the short-term effects of being exposed to local, acute incidents of violent crime on cognitive and non-cognitive outcomes (Heissel et al., 2017; Sharkey, 2010; Sharkey et al., 2014; McCoy et al., 2015), but causal evidence on the longer-term consequences of growing

[1] Baltimore and Milwaukee cannot join Chicago and Detroit on that list because of the spike in crime that they experienced in 2015, which brought the murder rate above the level in 1991. If changes are measured between 1991 and 2014, Baltimore and Milwaukee had reductions in their murder rates of 18 and 44 percent, respectively.

up in a violent context is more limited.

The research design compares the achievement at the end of eighth grade of seven birth cohorts born between 1996 and 2002. During these seven years, the violent crime rate fell by 23 percent nationally, and in school districts like Chicago and New York, the decline in violent crime over that period was greater than 35 percent. To produce causal estimates of the effect of crime on students' achievement, the research design leverages exogenous shocks to crime rates arising from the availability of funds to hire police officers in local police departments thorough the Community Oriented Policing Services (COPS) grants program.

The findings indicate that birth cohorts who started elementary school when crime rates were lower in their school district perform better in state accountability tests taken by the end of eighth grade, relative to older birth cohorts of the same school district who started elementary school when violent crime was higher. A 10 percent decline in violent crime raised the overall performance in ELA in the district by .04 standard deviations. Analyses by race/ethnicity and gender show that the benefits of declining violence are larger among black students, Hispanic students, and males. Models exploring the effect of violent crime on Mathematics achievement also suggest negative effects, but those are smaller and imprecisely estimated. Supplementary analyses indicate that the effect of crime on achievement is not driven by compositional changes in school districts that experienced the greatest crime drops or by changes in school district spending after the receipt of the COPS grants.

These findings provide additional evidence on the role that violence plays in shaping the developmental trajectories of children and add to a growing body of work that shows how place and geography structure economic mobility and opportunity in the United States (Chetty et al., 2014; Reardon et al., 2016a).

The Geography of Educational Achievement and Economic Mobility

Recent work by Reardon et al. (2016a) has reported large disparities in achievement levels and in racial/ethnic achievement gaps across school districts in the United States.

Whereas the mean achievement in school districts such as Brookline, MA and Cupertino, CA is the equivalent to three grades larger than the national mean, the mean academic achievement in the school districts of Camden, NJ and Detroit, MI is more than two grades below the country average. Similarly, the white-black achievement gap ranges from virtually zero in places like Hillside, NJ to more than one standard deviation in Cleveland, OH and Atlanta, GA. Descriptive evidence suggests that variation in mean achievement levels is highly correlated with the socioeconomic characteristics of the families living in the school district (Reardon, 2016). Similarly, racial/ethnic disparities are wider in school districts with larger racial/ethnic differences in parental income, larger differences in parental education levels, and higher levels of racial/ethnic segregation (Reardon et al., 2016a).

The work documenting achievement gaps across school districts adds to a growing set of findings showing that economic opportunity varies substantially by location. Using tax records from 40 million of Americans, Chetty et al. (2014) characterize the levels of intergenerational income mobility across counties, metropolitan areas, and states in the United States. They show that, depending on where they spend their adolescence, children born to low-income parents achieve widely different ranks in the income distribution as they enter adulthood. Places with the highest levels of intergenerational mobility have, on average, lower rates of residential segregation by income and race, lower levels of income inequality, better schools, lower violent crime rates, and a larger share of two-parent households (Chetty et al., 2014).

This body of work convincingly shows the extent to which educational achievement and economic mobility vary across space. These findings also suggest that places, rather than people living in them, are producing the disparities in economic mobility across space, and that neighborhood attributes are responsible for an important share of the disparities in educational achievement across school districts. This evidence adds to a well-established literature on neighborhoods effects that has shown how the residential context impacts children's developmental trajectories and educational outcomes (Sampson et al., 2008; Sharkey

and Elwert, 2011; Sharkey and Faber, 2014; Wodtke et al., 2011).

By themselves, these findings have made a groundbreaking contribution to our understanding of how geography shapes educational and economic opportunity. However, our knowledge of the causal mechanisms underlying these patterns is more limited. Building on an extensive body of evidence from ethnographic and quantitative studies that has shown that exposure to violent crime is a key pathway through which growing up in disadvantaged neighborhoods affects children's developmental trajectories (Burdick-Will et al., 2011; Harding, 2009; Harding et al., 2011; Sharkey, 2018a), this study aims to fill this gap by examining how the levels of violence where children grow up shape their academic achievement.

Neighborhood Crime and Educational Outcomes

A long tradition of scholarship in criminology, economics, and sociology has documented the negative consequences of growing up in violent neighborhoods (Aizer, 2007; Sharkey, 2018a). Studies examining the acute, short-term effects of crime have found that when children take cognitive assessments in the days after a homicide has occurred in their neighborhood, their performance declines relative to other children who were not exposed to violence in the days before the assessments were given (Sharkey, 2010; Sharkey et al., 2014). Evidence on non-cognitive outcomes shows that, in the aftermath of a violent crime, the ability to concentrate, self-regulatory behavior, cortisol levels, and sleeping patterns of children living nearby are severely affected (Heissel et al., 2017; McCoy et al., 2015; Sharkey et al., 2012).

The identification strategy of these studies is convincing, and they provide clear evidence on the short-term effects of living in close proximity of a violent crime. As Sharkey et al. (2014) state, "if estimates of acute effects are taken at face value, then the simple accumulation of acute disruptions to academic performance translates into consistent deficits in academic performance, with long-term consequences for academic trajectories." Despite this logic, the long-term, cumulative effects of growing up in a violent neighborhood and

their implications for educational inequality have deserved less attention.

The Moving to Opportunity (MTO) experiment was one of the largest efforts to generate causal evidence on the effects of moving families out of high-poverty neighborhoods. Although many things changed when families in the experimental groups moved out from high-poverty neighborhoods (e.g., the schools that children attended, the levels of neighborhood violence that surrounded them, and so on), the experiment's design did not allow researchers to test the mechanisms generating the impacts of moving out of poverty on the outcomes that were examined. However, a follow-up analysis of the data revealed that the largest gains in children's test scores occurred in the two cities in which the experiment generated the largest changes in exposure to neighborhood violence, Baltimore and Chicago (Burdick-Will et al., 2011). Surprisingly, the variation in school quality induced by the experiment did not explain the heterogeneity in treatment effects on test scores across the five cities in the MTO experiment.

In addition to the consequences of direct exposure or proximity to instances of violent crime, ethnographic studies have shown that children living in disadvantaged neighborhoods are forced to develop strategies to navigate threatening public spaces and change their daily routines and patterns of social interaction in a way that may negatively affect their educational development. Adolescents from disadvantaged and violent neighborhoods interact more frequently with older peers who provide them not only with street wisdom and safety, but also with alternative scripts and frames that shape their attitudes toward schooling (Harding, 2010). Similarly, boys and girls living in dangerous neighborhoods are forced to develop a reputation for being "though" (Anderson, 2000; Jones, 2009). Although earning this reputation may prevent youth from being victimized in the streets, it may complicate their interactions with teachers and school staff and affect their academic performance (Devine, 1996).

Beyond these effects on individuals, an extensive literature in criminology and urban sociology has documented the negative effects that crime has at the community level.

Neighborhood violence undermines the quality of life in entire communities, transforms the socio-demographic composition of neighborhoods, and leads to public and private disinvestment (Morenoff and Sampson, 1997; Sampson, 2012; Skogan, 1986). Recent evidence on these community-level effects of crime has shown that children born to low-income families experience lower levels of economic mobility if violent crime is higher in the county where they spend their adolescence (Sharkey and Torrats-Espinosa, 2017).

In sum, these studies show that crime is a salient attribute of children's environment that reaches beyond individuals who are directly victimized (Sharkey, 2018a). The spatial concentration of crime disrupts the functioning communities, lowers the quality institutions such as schools, and erodes the quality of resources that facilitate academic success. Building on this body of evidence, this study pushes the literature forward and takes a national perspective in the study of the long-term effect of crime on children's academic performance.

Data Description and Sample Selection

Educational Achievement Data

Data on academic achievement are obtained from the Stanford Education Data Archive (SEDA). The SEDA data include estimates of the average test scores of students in virtually all public school districts in the United States (Reardon et al., 2016b). The estimates are obtained from approximately 300 million state accountability tests taken by approximately 45 million students in grades 3 to 8 attending public and charter schools between school years 2008-2009 and 2014-2015, which represent virtually all third to eighth graders attending public and charter schools at that time.[2] Test scores are placed on a common scale, so that performance can be meaningfully compared across school districts, states, grades, and years. The achievement measures in the SEDA data are disaggregated by grade (3 to

[2] School districts are defined according the geographic catchment areas that include students in traditional public schools and local charter schools. Test scores from charter schools are included in the public school district in which they are chartered. For charter schools that are not chartered by a district, their tests scores are included in the district in which they are physically located (Reardon, 2018).

8), school year (2008-20009 to 2014-2015), subject (ELA and Mathematics), race/ethnicity (Asian, black, Hispanic, and white), and gender.[3]

Although the SEDA data are repeated cross-sections of achievement by grade and school year, they enable the possibility of studying the achievement trajectory of several birth cohorts. As stated before, the data include achievement measures in grades 3-8 for school years 2008-2009 to 2014-2015. This means that there are 12 birth cohorts represented in the SEDA data, although not all cohorts have achievement measures in all grades. Figure 1 shows which birth cohorts are included in the SEDA data and for which grades achievement measures are available. The 1996 and 2007 birth cohorts are the oldest and youngest birth cohorts represented in the data. Assuming that children begin first grade at the age of 6, children born in 1996 were in eighth grade in school year 2008-2009, and children born in 2007 were in third grade in school year 2014-2015. Given this data availability, eight-grade estimates from school years 2008-2009 to 2014-2015 capture the educational achievement of children born between 1996 and 2002.[4]

The analysis will focus on the overall achievement in the district, achievement by race and ethnicity (black, Hispanic, and white students), racial gaps in achievement (white-black gap and white-Hispanic gap), achievement by gender (females and males), and gender gaps in achievement (female-male gap). All measures of achievement are in standard deviation units of the national distribution.

Table 1 shows means and standard deviations for all measures of eight-grade achievement that will be used as outcomes in the analysis. Each column shows eight-grade achievement for each of the seven birth cohorts. When focusing on the overall ELA achievement in the district, we see that, on average, the set of school districts included in the sample scored

[3] For additional details on the construction of aggregate measures from student test score data see Ho and Reardon (2012) and Reardon and Ho (2015).

[4] As noted in Reardon (2018), this operationalization of cohorts does not ensure that a consistent pool of students is followed over time. The students in eighth grade in school year 2014-2015 in a given district are not the exact same ones who were in third grade in school year 2009-2010 in the same district. Students moving to other school districts or being retained in a grade will change the pool of students between third and eighth grade. Without access to student-level longitudinal data, this limitation is impossible to address. Its implications for the findings presented here are discussed in the last section.

.34 standard deviations below the mean of all school districts in the country when the 1996 cohort reached eighth grade and .18 standard deviations below the mean when the 2002 cohort reached eighth grade. When focusing on racial/ethnic measures of achievement, we see that black students scored .54 standard deviations below the mean of all school districts in the country when the 1996 cohort reached eighth grade and remained .42 standard deviations below the mean when the 2002 cohort reached eighth grade. Hispanic students scored .54 standard deviations below the national mean when the 1996 cohort reached eighth grade and .36 standard below the mean when the 2002 cohort reached eighth grade. White students scored .11 standard deviations above the national mean when the 1996 cohort reached eighth grade and remained .15 standard deviations above the mean when the 2002 cohort reached eighth grade.

Turning to racial/ethnic gaps, we see that the white-black gap in eight-grade ELA achievement grew from .65 standard deviations for the 1996 birth cohort to .67 standard deviations for the 2002 birth cohort. Although the achievement of both white and black students increased over time, the slight widening of the gap can be attributed to the relatively larger growth among white students. The white-Hispanic gap in eight-grade ELA achievement decreased from .65 standard deviations for the 1996 birth cohort to .51 standard deviations for the 2002 birth cohort.

When looking at gender differences, we see that, in the sample of school districts examined in this study, females outperform males in ELA. The female achievement was .21 standard deviations below the mean of all school districts in the country when the 1996 cohort reached eighth grade and .03 standard deviations below the mean when the 2002 cohort reached eighth grade. The male achievement was .47 standard deviations below the mean of all school districts in the country when the 1996 cohort reached eighth grade and remained .31 standard deviations below the mean when the 2002 cohort reached eighth grade. Similar patterns are present in group means, racial/ethnic gaps, and gender gaps.

School District Crime

Crime data are obtained from the FBI's Uniform Crime Report (UCR) program. UCR data contain crimes known or reported to local police agencies. Crime data at the local police agency level are linked to achievement data at the school district following a two-step process. In the first step, crime reports from local police agencies are assigned to census incorporated places (i.e., cities and towns) using the Law Enforcement Agency Identifiers Crosswalk from the National Archive of Criminal Justice Data. In the second step, places are crosswalked to school district boundaries in the SEDA data by identifying the place whose centroid falls inside the boundaries of a given school district. After UCR crime data are assigned to school districts, we can estimate the violent crime rate for the period when each birth cohort had not yet begun elementary school (i.e., when children were 0 to 6 years old). For example, crime data from years 1996-2002 can be used to determine the violent crime rate in the school district when the 1996 birth cohort was 0-6 years old.

Table 1 shows means and standard deviations for the violent crime crime at ages 0-6 for each of the seven birth cohorts in the study. The oldest cohort was 0-6 years old between 1996 and 2002, with an average violent crime rate for that period of 2,335 crimes per 100,000 residents. The youngest birth cohort was 0-6 years old between 2002 and 2008, with an average violent crime rate for that period of 1,989 crimes per 100,000 residents. This represents a 15 percent difference between the violent crime rate experienced by the oldest and youngest children in the sample. If instead of considering the difference in the 6-year moving average at ages 0-6 we focus on the difference in violent crime rates at birth, we find that the 1996 birth cohort was born when the violent crime rate was 2,491, whereas the 2002 cohort was born when the violent crime rate was at 2,024, a 19 percent difference.

COPS Data

Data on the COPS program are obtained from the Department of Justice,[5] and they include the number of full-time police officers that were hired through the grants program in each year. The instrument is constructed by computing the number of full-time officers per 100,000 residents that each local police department had received up to the year when a given birth cohort was 0-6 years old. Table 1 shows that, on average, 21 police officers had been hired for each 100,000 residents in the school district when the 1996 birth cohort was 0-6 years old. When the 2002 birth cohort was 0-6 years old, that number had increased to 32 police officers for each 100,000 residents in the school district.

Analytic Sample Selection

The selection of school districts begins with the 500 school districts with the largest student enrollment in grades 3-8 in school year 2008-2009. Districts included in the sample are those that have data on academic achievement in eighth grade for black, Hispanic, and white children and crime data when children of each birth cohort were 0-6 years old. The analytic sample includes 337 school districts. Of these districts, 79 have data on eight-grade achievement for three birth cohorts, 55 have data on eight-grade achievement for four birth cohorts, 78 have data on eight-grade achievement for five birth cohorts, 69 have data on eight-grade achievement for six birth cohorts, and 56 have data on eight-grade achievement for seven birth cohorts. This yields an unbalanced panel of 1,653 school district-cohort observations.

Empirical Strategy

The empirical strategy exploits geographic variation in achievement and crime across the 337 school districts and temporal variation across seven birth cohorts in a difference-in-

[5] The COPS data were collected by William Evans and Emily Owens, who generously shared them for this project.

differences framework. For each school district in the sample, we observe the achievement by the end of eighth grade of birth cohorts of children born between 1996 and 2002. Similarly, for each birth cohort we observe the violent crime rate in the school district when children of that cohort were between 0 and 6 years old. The estimation strategy will compare the differences in achievement at the end of eighth grade between children who were 0-6 years old in years 1996-2002 and children of the same school district who were 0-6 years old in years 2002-2008. The estimating equation takes the following form:

$$Y_{it} = \delta_{OLS}\, Crime_{it} + \boldsymbol{X'_{it}}\boldsymbol{\beta} + \boldsymbol{S'_i} + \boldsymbol{C'_t} + \epsilon_{it} \tag{1}$$

In Equation (1), Y_{it} is eight-grade achievement in ELA and Math in school district i for birth cohort t (measured in standard deviations of the national distribution), $Crime_{it}$ is the log average violent crime rate in school district i measured when birth cohort t was 0-6 years old (measured in crimes per 100,000 residents), $\boldsymbol{X'_{it}}$ is a vector of demographic controls for school district i measured when birth cohort t was 0-6 years old,[6] $\boldsymbol{S'_i}$ is a set of school district fixed effects, $\boldsymbol{C'_t}$ is a set of birth cohort fixed effects, and ϵ_{it} is an stochastic error term. Standard errors are clustered by school district.

The parameter of interest is δ_{OLS}, and it captures the association between changes in crime levels at ages 0-6 and changes in achievement by the end of eighth grade. The two sets of fixed effects, $\boldsymbol{S'_i}$ and $\boldsymbol{C'_t}$, will account for two potential sources of bias: time-invariant attributes of the school district and time trends that are common to all districts. However, causal identification will not be possible if within-district changes in crime rates over this period are endogenous. The next section discusses the implications of such scenario and proposes a strategy to deal with these endogeneity concerns.

[6] The vector of controls $\boldsymbol{X'_{it}}$ includes % non-Hispanic white, % non-Hispanic black, % Hispanic, % foreign-born, % unemployed, % families with income below the poverty line, and median household income (in 2000 USD). All these demographics are measured when the birth cohort was 0-6 years old (linearly interpolating between census years).

Two-Stage Least Squares Estimation

Estimating the impact of early exposure to violent crime on academic achievement by the end of middle school presents a number of empirical challenges that are difficult to overcome without an experimental design. We know that neighborhood violence is highly correlated with other attributes of neighborhoods, such as poverty and labor force participation, that may also have an impact on academic achievement (Aizer, 2007). One possibility would be to control for as many of these factors as the data allow, but the threat of having omitted one or more confounders would still be present. Another threat is the residential selection of families into school districts on the basis of socio-economic attributes that are predictive of academic performance (Sampson and Sharkey, 2008). If more affluent families have the ability to forecast changes in crime rates in their school district and decide to relocate to a safer school district, the higher achievement in low-crime school districts could be a reflection of this selective sorting of families with more resources into safer school districts.

To deal with these endogeneity concerns and obtain causal estimates of the the impact of crime on achievement, this study proposes a Two-Stage Least Squares (2SLS) estimation strategy that leverages arguably exogenous shocks to crime rates arising from the availability of funds to hire police officers in the local police departments where the school districts operate. Specifically, the 2SLS strategy exploits the timing of grants that law enforcement agencies received under the Community Oriented Policing Service (COPS) program. The COPS program was established in 1994 as part of the Violent Crime Control and Law Enforcement Act. Through the COPS Universal Hiring Program, police departments that applied for grants received funding to cover 75 percent of the cost of hiring and re-hiring entry-level career law enforcement officers. By end of fiscal year 2004, the COPS program had distributed $11.3 billion in grants, with $5 billion of these funds being spent to hire 64,000 new police officers (Evans and Owens, 2007). By 2016, the COPS program had distributed approximately $14.9 billion in grants across 13,000 law enforcement agencies (Office of Community Oriented Policing Services 2017).

Evans and Owens (2007) showed that the addition of police officers through the COPS grants program had a causal effect on violent and property crimes between 1990 and 2001. The average COPS grant reduced burglaries by 2.2 percent, auto thefts by 3.3 percent, robberies by 5 percent, murders by 3.2 percent, and assaults by 3.6 percent. They also showed that although the total grant amount received over the 1994-2002 period was correlated with the size of the police force and crime levels in 1993, there was no correlation between the timing of the receipt of the grants and prior crime trends.[7]

The system of equations in the 2SLS estimation takes the following form:

$$Crime_{it} = \pi_1 \, COPS_{it} + \boldsymbol{X'_{it}}\boldsymbol{\beta} + \boldsymbol{S'_i} + \boldsymbol{C'_t} + \epsilon_{it} \tag{2}$$

$$Y_{it} = \pi_2 \, COPS_{it} + \boldsymbol{X'_{it}}\boldsymbol{\beta} + \boldsymbol{S'_i} + \boldsymbol{C'_t} + \epsilon_{it} \tag{3}$$

In both equations, $COPS_{it}$ is the number of police officers that had been hired through the COPS program by the municipal police department operating in district i when birth cohort t was 0-6 years old (measured in police officers per 100,000 residents in the district), Y_{it} is eight-grade achievement in ELA and Mathematics in school district i for birth cohort t (measured in standard deviations of the national distribution), $Crime_{it}$ is the log average violent crime rate in school district i measured when birth cohort t was 0-6 years old (measured in crimes per 100,000 residents), $\boldsymbol{X'_{it}}$ is a vector of demographic controls for school district i measured when birth cohort t was 0-6 years old, $\boldsymbol{S'_i}$ is a set of school district fixed effects, and $\boldsymbol{C'_t}$ is a set of birth cohort fixed effects. As before, standard errors are clustered by school district.

Equation (2) is the first-stage equation, and it will estimate the impact of the COPS grants on the violent crime in the district, π_1. Equation (3) is the reduced-form equation,

[7] To better understand what led to the seemingly random allocation of COPS funds, Evans and Owens supported their empirical findings with qualitative evidence gathered through interviews with representatives of police agencies. Those interviews revealed that police agencies faced low barriers to apply and a simple application process. Once an agency received a grant, subsequent grants were awarded with minimal paper work. Furthermore, the disbursement of the requested funds was made in an arbitrary way, and in some instances, the COPS office actively solicited grant applications.

and it will estimate the impact of the COPS grants on the eight-grade achievement in the district, π_2. The 2SLS estimate of the effect of crime on eight-grade achievement, δ_{2SLS}, is obtained by dividing the reduced-form estimate over the first-stage estimate ($\delta_{2SLS} = \pi_2/\pi_1$).

Figure 2 shows an event study with first-stage and reduced-form estimates for ELA and Mathematics when adding different lags and leads to the instrument. Each point estimate shown in Figure 2a corresponds to the effect of the COPS instrument on violent crime when the number of police officers hired in the district is measured a few years before and a few years after the time when the violent crime rate is measured. For example, the point estimate on the far left shows the effect of the instrument on violent crime when the instrument is measured three years before the window in which the birth cohort was 0-6 years old. The point estimate on the far right shows the effect of the instrument on violent crime when the instrument is measured three years after the window in which the birth cohort was 0-6 years old. The sequence of leads and lags shows that the receipt of the COPS grants in the past reduced crime rates in the present (estimates 3y lag to 1y lag in Figure 2a), but the receipt of the COPS grants in the future did not affect violent crime in the present (estimates 1y lead to 3y lead in Figure 2a). Another way of interpreting Figure 2a is that the receipt of the COPS grants was unrelated to prior trends in violent crime rates in the district, which is in line with findings from Evans and Owens (2007).

Table 2 complements Figure 2a and reports first-stage results when both the instrument and violent crime are measured when children were 0-6 years old, which correspond to the point estimate in the middle of Figure 2a. Column 1 excludes the vector of controls $\boldsymbol{X}'_{it}$ from the regression, and Column 2 includes them. Column 1 shows that, in a school district of 100,000 residents, the hiring of one additional police officer through the COPS program led to a 1.1 percent decline in the violent crime rate. Column 2 shows that adding the set of controls reduces the estimate to .9 percent. In both specifications, a Wald test on the instrument yields an F-statistic above 30, which meets the criterion suggested by Stock and Yogo (2005) to avoid problems associated with weak instruments.

Figures 2b and 2c follow the same logic than Figure 2a and show the reduced-form estimate when the number of police officers hired in the district is measured a few years before and a few years after the time when the violent crime rate is measured. If the instrument only affects achievement through its effect on violent crime rates, we should find no effect of the instrument on achievement when the instrument did not affect crime rates. Looking at Figure 2a, we see that the receipt of COPS grants in the future did not affect crime rates in the present (i.e., when one- to three-year leads are added to the instrument). In those instances, achievement should have not been affected either. This condition could have been violated if, for example, the COPS grants were given to police departments operating in school districts where achievement was already improving prior to the receipt of the grants. Figure 2b shows no evidence of this being the case. The hiring of police officers only led to improvements in ELA achievement when the hiring took place before the time when violent crime rate is measured. A similar pattern of lags and leads emerges for Mathematics achievement in Figure 2c, although the direct effect of the instrument on achievement is imprecisely estimated.

Considering the reduced-form estimate in the middle of Figure 2b, which corresponds to a reduced-form regression in which both the instrument and violent crime are measured when children were 0-6 years old, we find that each police officer hired through the COPS grant in a district with 100,000 residents led to an increase in ELA achievement in the district of .004 standard deviations. For an average increase in the number of police officers hired through the COPS grants per 100,000 residents at ages 0-6 of 12, ELA achievement at the end of eighth grade increased by .05 standard deviations.

Results

Effect of Violent Crime on the Mean Achievement in the District

Before moving to the regression results from the difference-in-differences estimation, it can be informative to look at how achievement across districts correlates with crime

ignoring changes over time in crime and achievement. Figure 3 shows the cross-sectional association between the violent crime rates in the district when birth cohorts were 0-6 years old and the ELA and Mathematics achievement by eighth grade. For these cross-sectional scatterplots, the district-level measures of crime and achievement have been averaged over the seven birth cohorts. The scatterplots reveal a strong, negative correlation between crime experienced at ages 0-6 and ELA and Mathematics achievement by the end of eighth grade. On average, school districts with a violent crime rate one standard deviation above the mean show a performance level in ELA that is .59 standard deviations below the national mean ($R^2 = .35$) and a performance level in Mathematics that is .56 standard deviations below the national mean ($R^2 = .31$). These negative associations hold when controlling for the set of covariates in $\boldsymbol{X'_{it}}$ (averaged over the seven birth cohorts).

The next set results are shown in Figure 4 and correspond to the difference-in-differences estimation described above. The figure reports OLS and 2SLS estimates (with 95 percent confidence intervals) of the effect of changes in violent crime on changes in achievement, δ_{OLS} and δ_{2SLS}. Figure 4a shows estimates for ELA models, and Figure 4b shows estimates for Mathematics. Each figure reports estimates when including and excluding the vector of demographic controls, $\boldsymbol{X'_{it}}$.

On the basis of the OLS estimates, the overall ELA achievement in the district increased by .01 standard deviations for each 10 percent decline in violent crime. Estimates for Mathematics are less than half the size of ELA estimates, and they are imprecisely estimated. The 2SLS estimates indicate that the overall ELA achievement in the district increased by .04 standard deviations for each 10 percent decline in violent crime. The 2SLS estimate for Mathematics corresponds to a .03 standard deviations increase in achievement for each 10 percent decline in crime (when including the set of controls $\boldsymbol{X'_{it}}$), although this estimate is imprecisely estimated.

Effect of Violent Crime by Race and Gender

The next set of analyses takes advantage of the race- and gender-specific achievement estimates in the SEDA data. Using the same difference-in-differences framework, this part of the analysis estimates the effect of changes in violent crime in the district on the achievement of black, Hispanic, and white students, separately, and on the achievement gap between white and black students and between white and Hispanic students. For gender, it estimates the effect of changes in violent crime on the achievement of females and males, separately, and on the achievement gap between female and male students.

Figure 5a shows race-specific 2SLS estimates of the effect of violent crime on the ELA achievement. For each 10 percent decline in violent crime rate, the ELA achievement of black and Hispanic students increased by .03 and .02 standard deviations, respectively. The ELA achievement of white students did not change as crime rates declined. When looking at racial gaps, for each 10 percent decline in violent crime rate, the white-black achievement gap in ELA closed by .04 standard deviations and the white-Hispanic achievement gap in ELA closed by .03 deviations. Figure 5b shows estimates for Mathematics achievement. All estimates are of the same sign than those from ELA models, but they are imprecisely estimated.

When assessing the estimates by race from Figure 5, it is important to remember that the race-specific achievement measures in the SEDA data are measured in standard deviations of the national distribution of all students. This means that they capture how students of a given race in the district score in relation to the entire pool of students in the SEDA data. Therefore, on the basis of the 2SLS estimates in ELA models, black and Hispanic students moved .04 and .03 standard deviations closer to the national mean. Considering that school districts that score higher in the national distribution are likely to be predominately white, these results suggest that the decline in crime reduced inequality in achievement because of the gains that accrued to black and Hispanic students.

Figure 6a shows gender-specific 2SLS estimates of the effect of violent crime on ELA

achievement. For each 10 percent decline in violent crime rate, the ELA achievement of female and male students increased by .02 and .06 standard deviations, respectively, and the female-male gap closed by .04 standard deviations. Figure 6b shows that for each 10 percent decline in violent crime rate, the Mathematics achievement of male students increased by .04 and the female-male Mathematics achievement gap closed by .02 standard deviations.

Estimating the Educational Return of the COPS Grants

Up to this point, the interpretation of results has focused on the second-stage estimates, δ_{2SLS}, which provide a causal estimate of the effect of crime on achievement. In most instrumental variable analyses, the interpretation of results would end here. However, given the nature of the instrument being used here, the reduced-form estimates have a meaningful interpretation with clear policy implications. Specifically, π_2 will capture the causal effect of hiring one additional police officer through the COPS grants on school achievement in the district. Knowing the average cost of hiring one police officer, we can estimate the return in standard deviations of each dollar spent through the COPS program.

Going back to Figure 2b, the ELA reduced-form estimate that corresponds to the set of findings discussed above is .003. This means that in a school district with 100,000 residents, hiring and retaining one additional police officer increased the ELA achievement of students in each cohort in the district by .003 standard deviations. The average size of a birth cohort attending public schools in a school district with 100,000 residents is 1,868 children.[8] If we round this figure up to 2,000 to include students in charter schools, we get that in a district with 2,000 students in each cohort, hiring one police officer through the COPS grant raised the average eighth-grade ELA performance of the birth cohort by .03 standard deviations. Considering that the average cost of hiring one police officer through the COPS grants in the sample of school districts in the analysis was $153,211 (in 2015 USD), we get that an average per pupil spending of $76 increased the achievement in the

[8]This figure corresponds to the average enrollment per grade in years 1994-2008 in the set of 337 school districts included in the sample.

district by .003 standard deviations. Equivalently, $2,533 of per pupil spending increased the ELA achievement by .1 standard deviations. Lafortune, Rothstein and Schanzenbach (2018) estimate that an increase in state aid per pupil per year of $622 and an increase in total revenue per pupil per year of $424 following school finance reforms raised achievement in the district by .1 standard deviations. If we compare the return of the COPS program to the return of education interventions that targeted student outcomes, its impact seems small. However, if we think of the increase in achievement documented here as an unintended consequence of an intervention not aimed at improving student outcomes, the return is sizable.

Changes in School District Composition and Financial Resources

The instrumental variable strategy used above represents an attempt to produce causal estimates. However, several elements of the data and the research design could cast doubt on the validity of the estimates reported before. This section will explore the extent to which the improvements in achievement are driven by compositional changes in the pool of students in districts that experienced the greatest declines in violent crime, or by increases in school district spending after the receipt of the COPS grants.

Changes in Enrollment and Economic and Racial Composition in the District

One limitation of the SEDA data is that they represent repeated cross-sections of districts over several school years (Reardon, 2018). As such, it is impossible to determine, for example, whether the children who started third grade in school year 2009-2010 are the same ones that were in eighth grade by school year 2014-2015. Students moving to other school districts or being retained in a grade will change the pool of students between third and eighth grade. Changes in the composition of the student body would not be problematic if they occurred at random. However, if the composition of birth cohorts changed with crime rates, that would undermine the validity of the estimates. For example, if high-income families

moved in greater numbers into school districts that became safer, that would increase the mean achievement in the district. Similarly, if low-income families stayed in school districts where violent crime had declined the least, the mean achievement in those districts would remain low.

To assess the extent to which the decline in crime changed the composition school districts over time, Figure 7 reports 2SLS results from models estimating the effect of changes in violent crime on changes in enrollment by grade and on the economic and racial composition of school districts. This part of the analysis uses data from the Public Elementary/Secondary School Universe Survey Data from the National Center for Education Statistics for years 1994 to 2008. Among other demographics, these data include counts of students enrolled in each grade in the district, the total number of students enrolled in the district, the number of students with free and reduced-price lunch (FRL) eligibility (a proxy for the number of low-income students[9]), and the number of students of each racial/ethnic group.[10]

None of the point estimates in Figure 7a indicates that enrollment in the district changed as crime rates fell. These results are not very surprising because changes in student enrollment are determined, in large part, by the district's capacity of increasing the number of schools or the number of classrooms per school, which are both unlikely to change substantially from year to year. Figure 7b reports 2SLS estimates of the effect of changes in violent crime rate on the economic and racial composition in the district.[11] The point

[9] Using FRL eligibility status to measure the extent to which the economic composition in the district changed is an imperfect way of doing so, but given data limitations, it is the most common approach in the education literature. See, for example, Owens et al. (2016).

[10] The estimation follows the same logic than Equations (2) and (3). The first-stage equation is $Crime_{it} = \pi_1 COPS_{it} + \boldsymbol{S_i'} + \boldsymbol{C_t'} + \epsilon_{it}$. The second-stage equation is $Y_{it} = \pi_2 COPS_{it} + \boldsymbol{S_i'} + \boldsymbol{C_t'} + \epsilon_{it}$. $Crime_{it}$ is the log of the violent crime rate in school district i in year t, $COPS_{it}$ is the number of police officers per 100,000 residents hired through the COPS grants in school district i in year t, Y_{it} is the corresponding measure of enrollment or composition in district i in year t, and $\boldsymbol{S_i'}$ and $\boldsymbol{C_t'}$ are school district and year fixed effects. The reduced-form estimate is π_2, and it captures the effect of the COPS instrument on the outcome Y_{it}. The second-stage estimate is the causal effect of $Crime_{it}$ on on the outcome Y_{it}, and it can be obtained by dividing π_1 over π_2. The sample includes the same 337 school districts used in the previous analyses. Changes in COPS grants, crime, and enrollment and composition outcomes are measured year-to-year from 1994 to 2008.

[11] Measures of economic an racial composition are estimated for the entire district (i.e., pooling all students in grades K-12).

estimate at the top of Figure 7b provides no indication that the share of low-income students changed as crime rates fell. However, estimates of the effect of crime on the district's racial composition indicate that, as crime rates fell, the share of minority students declined and the share of white students increased. For a 10 percent decline in violent crime, the share of white students increased by 1.1 percentage points and the shares of black and Hispanic students decreased by .6 percentage points each.

Results from Figure 7b could appear problematic because they could suggest that part of the increase in achievement documented earlier is driven by white families moving into school districts that became safer. If the analysis did not include estimates of crime on achievement by race, the pattern in Figure 7b would be evidence that the improvement in academic performance in school districts where crime rates fell more rapidly was due to a larger share of white students moving in and driving up the mean, instead of being the result of the channels identified in previous studies of the effects of crime on children outcomes. However, in thinking about this possibility, it is important to remember that the measures of ELA and Mathematics achievement by race/ethnicity in the SEDA data rank the district relative to the national mean based on the scores of students of the corresponding racial/ethnic group. Therefore, by construction, the mean performance of one racial group cannot be affected by having more or less members of another racial group in the district. In fact, the analyses by race reported in Figure 5 estimate how the performance of students of one racial/ethnic group compares to the performance of students of that same racial/ethnic group across districts with different violent crime rates. This element of the study design rule out the possibility that changes in the racial composition of the district explain the findings documented earlier.[12]

[12] Although the mean achievement of one race/ethnicity cannot be mechanically affected by the scores of students of another group, racial/ethnic groups could influence each other via peer effects. It could be possible that a larger share of white students in the classroom made black and Hispanic students perform better in their tests.

Impact of the COPS Grants on School District Finance

Another explanation for the findings on crime and achievement could be that public schools received more resources as cities received federal funds to hire police officers. One could imagine a scenario in which a city had allocated certain funds at the beginning of the fiscal year to hire police officers, but when the city received the COPS grant, those funds were reallocated to the public school system in the city. That would represent a violation of the exclusion restriction in the 2SLS estimation because the instrument would have an effect on achievement through a channel other than the reduction in crime rates.

To assess this possibility, Figure 8 reports estimates of the effect of hiring police officers through the COPS grants on expenditures, salaries, and employee benefits in the school district.[13] Data on school finance are obtained from Local Education Agency Finance Surveys of 1994 to 2008 from the National Center for Education Statistics. None of the point estimates reported in Figure 8 suggests that school districts increased their expenditures, salaries, or employee benefits after the city received the COPS grants.

Discussion

Although violent crime rates in America still remain higher than in most developed countries (United Nations Office on Drugs and Crime, 2017), the decline in violence that began in the early 1990s represents a major improvement in the quality of life of Americans. While much has been written about the causes of the crime decline (Levitt, 2004; Zimring, 2006), we have made less progress in understanding its consequences for individuals and communities. This study makes an attempt to fill this gap by estimating the impact of declining crime rates on the educational achievement of seven birth cohorts who entered the

[13] The estimating equation has the following form: $Y_{it} = \beta\, COPS_{it} + \boldsymbol{S_i'} + \boldsymbol{C_t'} + \epsilon_{it}$, where Y_{it} is the log of expenditures, salaries, or employee benefits (in 2015 USD) in school district i in year t; $COPS_{it}$ is the number of police officers per 100,000 residents hired through the COPS grants in school district i in year t; and $\boldsymbol{S_i'}$ and $\boldsymbol{C_t'}$ are school district and year fixed effects. The sample includes the same 337 school districts used in the previous analyses. Changes in COPS grants and school finances are measured year-to-year from 1994 to 2008.

school system when the violent crime rate in their school districts was markedly different.

The oldest cohort of children in this study was born in 1996, when the national violent crime rate was at 636 crimes per 100,000 residents. The youngest cohort was born in 2002, when the national violent crime rate was 494, a 23 percent decline from the 1996 level (United States Department of Justice, 2015). Being only seven years apart meant living through childhood and adolescence with a lower risk of being victimized in the streets and of experiencing the trauma and stress associated with living in violent environments. When comparing the achievement at the end of eighth grade of children born between 1996 and 2002, we see that experiencing a 10 percent decline in violent crime raised the performance in ELA of an entire birth cohort by .04 standard deviations.

Analyses by race show that the negative effects of crime on achievement are larger among black and Hispanic students. In a context of declining violence, this means that the crime drop reduced the racial achievement gap between white and minority students. For a 10 percent decline in violent crime, the district-wide ELA achievement gap between white and black students closed by .04 standard deviations and the district-wide ELA achievement gap between white and Hispanic students closed by .03 standard deviations. These findings are consistent with existing evidence from studies that documented that the acute effect of exposure to homicides on students' performance is larger among black students and in predominantly black schools (Sharkey, 2010; Sharkey et al., 2014; Gershenson and Tekin, 2017). Violent crime is spatially concentrated in the neighborhoods where racial minorities live (Morenoff and Sampson, 1997; Peterson and Krivo, 2010; Sampson et al., 1997), and these are the neighborhoods that experienced the largest declines in crime in the 1990s and 2000s (Friedson and Sharkey, 2015).

A novel finding emerging from this study is the larger effect of crime among boys. On the basis of the IV estimates in Figure 6, the achievement gap between female and male students closed by .04 standard deviations in ELA and by .02 standard deviations in Mathematics. While girls are also exposed to community violence and forced to develop strategies

to navigate threatening school and street environments (Jones, 2009), the most severe consequences of neighborhood violence are experienced by young, minority men (Anderson, 2000; Harding, 2010). From this perspective, it makes sense that boys experienced the largest increases in achievement as their neighborhoods became safer.

Focusing on the coefficient magnitudes, the size of these effects may appear small. However, it is worth remembering that these improvements in achievement are averaged over all students in the school district. These estimates imply that the effect might be larger for children living in neighborhoods where crime was more concentrated and where the crime drop was felt more intensely (Friedson and Sharkey, 2015). Similarly, data limitations do not allow taking a longer term view and comparing, for example, the achievement of children born in the late 1980s and children born in the early 2000s. These two sets of children lived through school years in vastly different neighborhood and school environments in terms of levels of violence, and it is plausible to assume that such comparison would render much larger effect sizes.

The evidence on ELA achievement is clear and strong, but the effect of violent crime on Mathematics is inconclusive. All point estimates for Mathematics are in the same direction than those in ELA models, but their magnitudes are smaller and, in some models, imprecisely estimated. This pattern is consistent with findings from other studies of violence and student outcomes (Sharkey, 2010; Sharkey et al., 2014). These studies have reconciled this finding by suggesting that achievement in math and reading may be explained by different self-regulatory mechanisms that interact differently with violence-related stressors (Liew et al., 2008). While this hypothesis seems plausible to make sense of findings in studies that examine acute, short-term effects of crime, it is unclear whether one should expect similar findings in a study aimed at estimating the long-term effects of crime on school achievement. With the availability of longitudinal data, further research should investigate the extent to which the cumulative effects of being exposed to neighborhood violence explain the math and reading differences.

The most important limitation of this study is that it provides no evidence on the mechanisms driving the improvement in achievement as crime rates fell. The study design has restricted the measurement of exposure to crime before children entered the school system, and a number of supplementary analyses have shown that the COPS funds did not change school resources and that the effects are not driven by changes in the economic and racial composition of school districts over time. It is unclear, however, whether children born in the 2000s did better because they were able to stay more focused on school as their surroundings became safer, or because safer streets meant that parents were more willing to enroll them in extra curricular activities that furthered their development, for example. Future research that surveys children about their perceptions of safety and parents about their strategies to shield children from street crime can help unpack these mechanisms.

Considering the reduced-form estimates and the cost of hiring one police officer through the COPS grants, the findings presented here suggest that a per pupil spending of $2,533 raised the ELA achievement in the district by .1 standard deviations. This return is substantially smaller than the return of existing education interventions. However, considering that the COPS program did not have the improvement of academic outcomes as its primary goal, the indirect return of the program on student achievement is important.

The discussion of the consequences of the crime decline cannot ignore the costs of such change. A shift toward more aggressive forms of policing and soaring incarceration rates have disrupted the lives of minority youth as much as street violence did in the 1980s and early 1990s. More police in the streets cannot be the only response to confront community violence, and the reduced-form estimates from Figure 2 do not mean that to close achievement gaps we need more police in the streets. Giving more resources to police departments so that they can engage and partner with community organizations and provide effective responses to communities' needs is a policy recommendation that should generate consensus. However, law enforcement agencies should be held accountable so that they carry their jobs with fairness and without engaging in discriminatory practices. This accountability requirement

is of crucial importance in light of recent qualitative and quantitative evidence showing the negative effects of policing on minority youth (Rios, 2011; Legewie and Fagan, 2018).

The findings from this study add to a growing body of work showing that economic opportunity varies substantially by location (Chetty et al., 2014), and they suggest that the effect of crime on economic mobility documented before operates, in part, through educational achievement (Sharkey and Torrats-Espinosa, 2017). If places, rather than people living in them, are responsible for the differences in economic mobility across metropolitan areas (Chetty and Hendren, 2018), making places safer can generate long-term social returns that extend beyond the most immediate and direct benefits of reducing community violence. More broadly, these findings provide additional evidence on the role that violence plays in shaping the developmental trajectories of children, and they reinforce the idea that understanding differences in academic achievement requires evidence on what happens inside schools as well as what happens outside schools.

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Figures and Tables

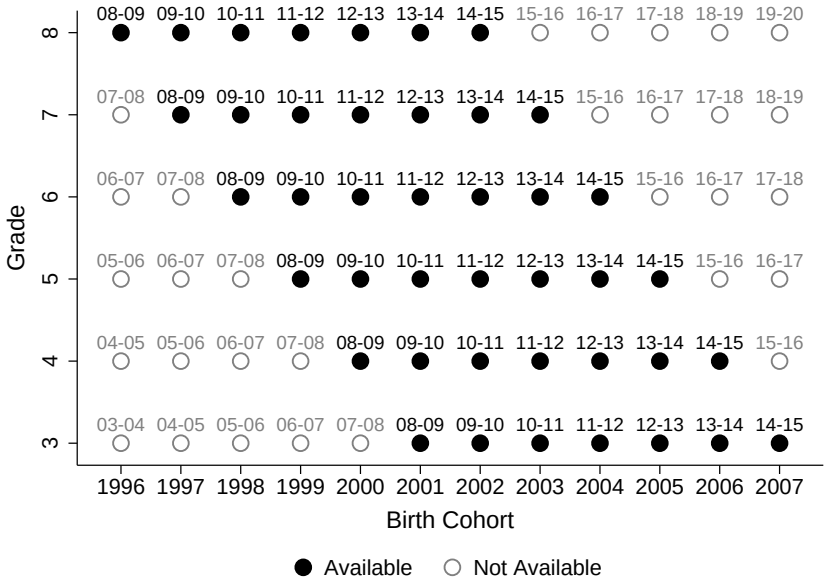
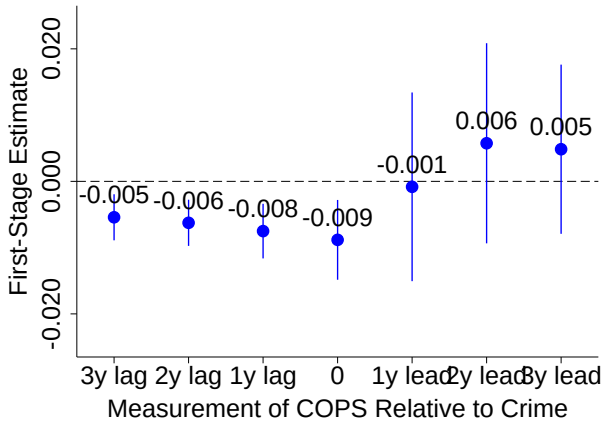


Figure 1: Birth Cohorts in the SEDA Data

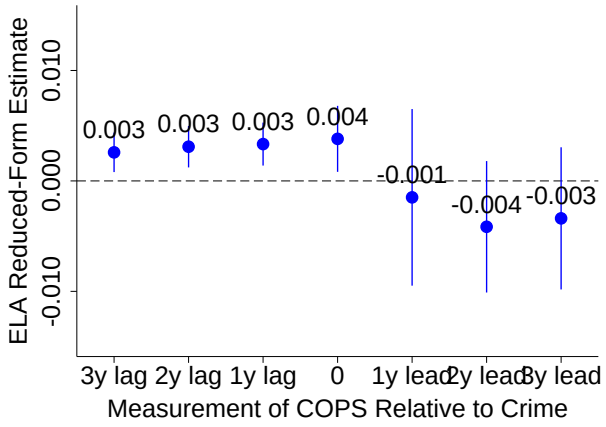
Table 1: Descriptive Statistics, By Birth Cohorts

	Birth Cohorts						
	1996	1997	1998	1999	2000	2001	2002
ELA Achievement in 8th Grade							
All Students	-0.34	-0.34	-0.29	-0.26	-0.20	-0.25	-0.18
	(0.27)	(0.26)	(0.27)	(0.27)	(0.27)	(0.33)	(0.32)
Black	-0.54	-0.55	-0.51	-0.49	-0.45	-0.54	-0.52
	(0.22)	(0.20)	(0.21)	(0.19)	(0.20)	(0.27)	(0.32)
Hispanic	-0.54	-0.52	-0.46	-0.43	-0.37	-0.42	-0.36
	(0.21)	(0.19)	(0.21)	(0.20)	(0.21)	(0.22)	(0.24)
White	0.11	0.14	0.21	0.24	0.26	0.14	0.15
	(0.31)	(0.33)	(0.32)	(0.35)	(0.32)	(0.39)	(0.35)
White-Black Gap	0.65	0.69	0.72	0.73	0.71	0.68	0.67
	(0.30)	(0.34)	(0.31)	(0.33)	(0.28)	(0.35)	(0.28)
White-Hispanic Gap	0.65	0.66	0.66	0.67	0.62	0.56	0.51
	(0.29)	(0.33)	(0.28)	(0.31)	(0.27)	(0.34)	(0.29)
Female	-0.21	-0.21	-0.15	-0.12	-0.06	-0.11	-0.03
	(0.28)	(0.26)	(0.28)	(0.26)	(0.27)	(0.32)	(0.31)
Male	-0.47	-0.46	-0.42	-0.39	-0.33	-0.39	-0.31
	(0.28)	(0.26)	(0.28)	(0.28)	(0.28)	(0.34)	(0.34)
Female-Male Gap	0.26	0.25	0.27	0.27	0.26	0.28	0.30
	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.10)
Math Achievement in 8th Grade							
All Students	-0.24	-0.20	-0.16	-0.23	-0.15	-0.24	-0.21
	(0.33)	(0.32)	(0.34)	(0.29)	(0.28)	(0.33)	(0.37)
Black	-0.56	-0.52	-0.47	-0.53	-0.51	-0.61	-0.58
	(0.24)	(0.23)	(0.27)	(0.20)	(0.21)	(0.27)	(0.29)
Hispanic	-0.40	-0.36	-0.31	-0.38	-0.33	-0.40	-0.39
	(0.24)	(0.24)	(0.28)	(0.21)	(0.23)	(0.23)	(0.27)
White	0.19	0.23	0.27	0.24	0.30	0.10	0.11
	(0.33)	(0.33)	(0.34)	(0.33)	(0.32)	(0.36)	(0.37)
White-Black Gap	0.75	0.75	0.74	0.78	0.81	0.72	0.70
	(0.26)	(0.28)	(0.26)	(0.27)	(0.24)	(0.31)	(0.30)
White-Hispanic Gap	0.59	0.59	0.58	0.62	0.63	0.50	0.51
	(0.26)	(0.29)	(0.27)	(0.25)	(0.25)	(0.31)	(0.30)
Female	-0.22	-0.17	-0.13	-0.19	-0.11	-0.20	-0.16
	(0.32)	(0.31)	(0.33)	(0.28)	(0.28)	(0.32)	(0.36)
Male	-0.26	-0.24	-0.19	-0.26	-0.20	-0.28	-0.27
	(0.35)	(0.33)	(0.35)	(0.30)	(0.29)	(0.35)	(0.39)
Female-Male Gap	0.04	0.06	0.06	0.06	0.09	0.09	0.11
	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.09)
Violent Crime Rate							
Averaged at Ages 0-6	2335.67	2238.15	2195.32	1877.63	1803.61	2026.42	1989.61
	(1059.96)	(1079.00)	(1076.97)	(1155.89)	(1142.19)	(965.34)	(821.42)
At Birth	2491.28	2362.99	2296.92	1925.11	1890.70	2155.95	2024.31
	(1131.20)	(1106.82)	(1083.35)	(1095.05)	(1111.95)	(1064.10)	(789.40)
COPS Grants							
COPS Officers at Ages 0-6	20.78	25.34	26.98	36.45	37.58	30.66	32.85
	(12.63)	(15.13)	(16.85)	(17.73)	(18.82)	(19.12)	(18.03)

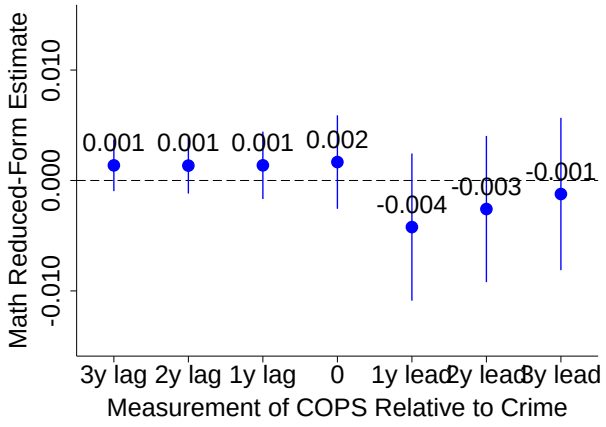
* 0.10 ** 0.05 *** 0.01. Standard errors clustered by school district in parentheses. All models include school district fixed effects, cohort fixed effects, and precision weights.



(a) First-Stage



(b) Reduced-Form ELA



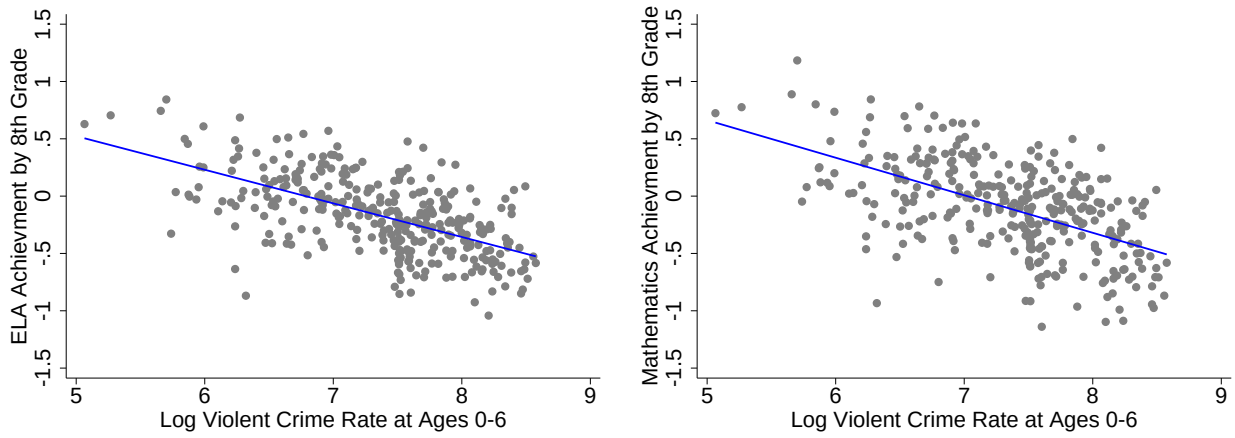
(c) Reduced-Form Mathematics

Figure 2: Event Study Adding Lags and Leads to the COPS Instrument

Table 2: First-Stage Estimates

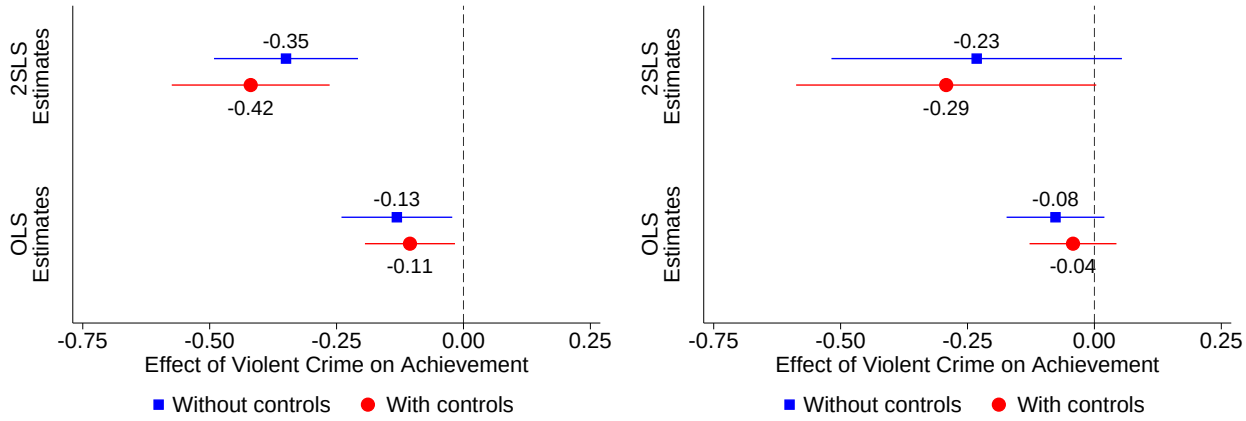
	Log violent	
	(1)	(2)
COPS Officers	-0.011***	-0.009***
	(0.002)	(0.002)
Observations	1,653	1,653
R^2	0.985	0.986
F-stat	30.076	31.345
Controls	No	Yes

* 0.10 ** 0.05 *** 0.01. Standard errors clustered by school district in parentheses. All models include school district fixed effects, cohort fixed effects, and precision weights.



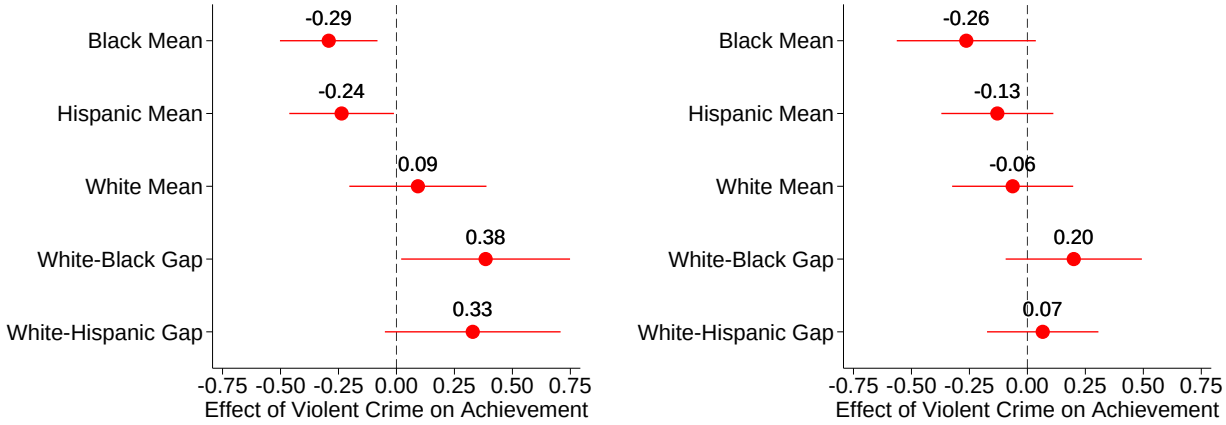
(a) ELA **(b)** Mathematics

Figure 3: Cross-Sectional Relationship between Violent Crime and Achievement



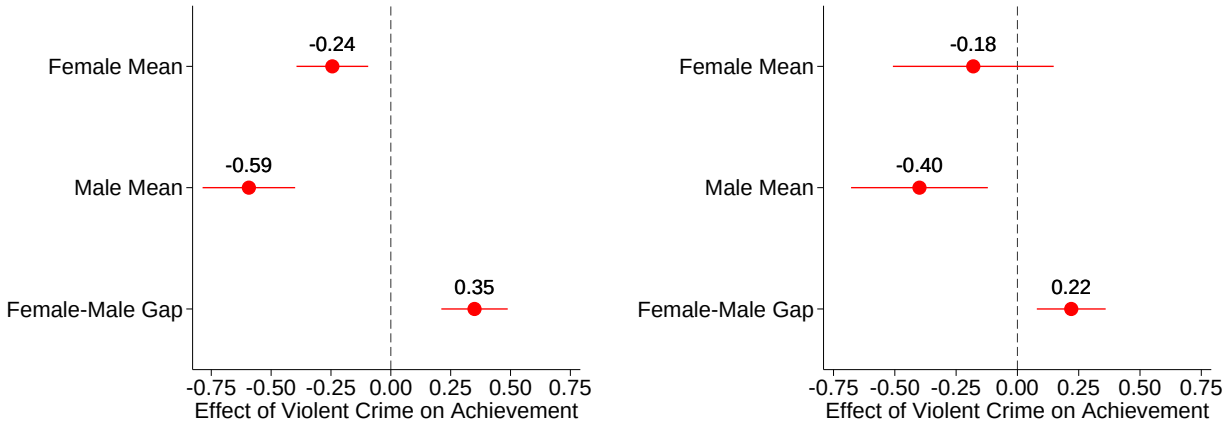
(a) ELA **(b)** Mathematics

Figure 4: OLS and 2SLS Estimates for All Students



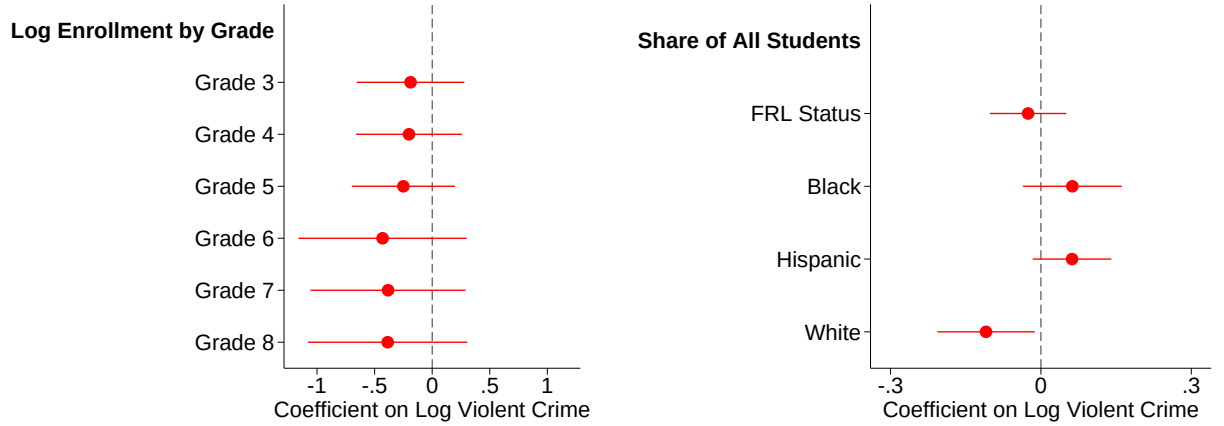
(a) ELA **(b)** Mathematics

Figure 5: 2SLS Estimates by Race



(a) ELA **(b)** Mathematics

Figure 6: 2SLS Estimates by Gender



(a) Enrollment by Grade **(b)** Economic and Racial Composition

Figure 7: 2SLS Estimates for Enrollment and Economic and Racial Composition, 1994-2008

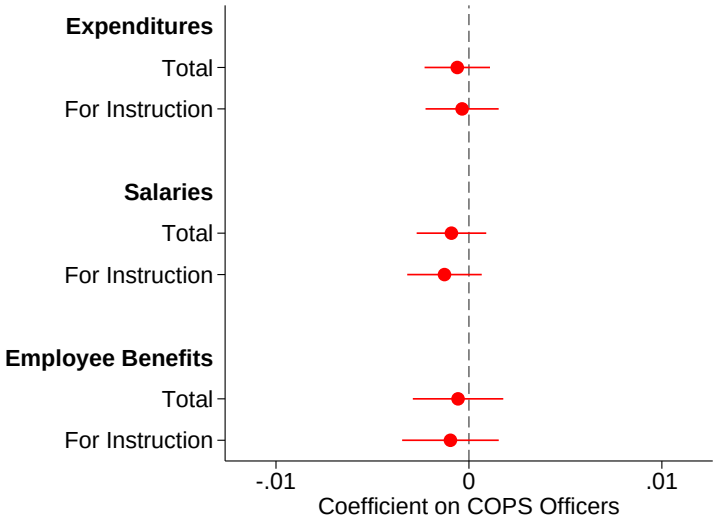


Figure 8: Effect of COPS Hiring on School District Finances, 1994-2008